

PROCEEDINGS
OF THE
AMERICAN PHILOSOPHICAL SOCIETY.

VOL. I. NOVEMBER & DECEMBER, 1838. No. 5.

Stated Meeting, November 2.

Present, twenty-eight members.

Mr. DU PONCEAU, President, in the Chair.

The following donations were received:—

FOR THE LIBRARY.

Nieuwe Verhandelingen der Eersteklasse van het Koninklijk-Nederlandsche Instituut te Amsterdam. Vols. VI. & VII. Amsterdam, 1837 & 1838.—*From the Institute.*

Tijdschrift voor Natuurlijke Geschiedenis en Physiologie. Uitgegeven door J. van der Hoeven, M. D. en W. H. de Vriese, M. D. Vol. IV. Leyden, 1837 & 1838.—*From the Minister of the Interior of the Netherlands.*

Flora Batava. Nos. 108 & 114. Amsterdam.—*From the same.*

The American Journal of Science and Arts. Conducted by Benjamin Silliman, M. D., aided by Benjamin Silliman, Jr., A. B. Vol. XXXV. No. 1. New Haven, 1838.—*From the Conductors.*

Annals of the Lyceum of Natural History of New York. Vol. IV. Nos. 1, 2, 3 & 4. New York, 1837.—*From the Lyceum.*

A View of the Commerce between the United States and Rio de Janeiro, Brazil. By John M. Baker, late U. S. Consul for Rio de Janeiro. Washington, 1838.—*From Mr. John Vaughan.*

Museum Ichthyologicum, sistens Piscium qui in Museo L. T. Gronovii adservantur, Descriptiones. Amsterdam, 1754.—*From the same.*

Eulogy on Nathaniel Bowditch, LL. D. Delivered before the American Academy of Arts and Sciences, May 29, 1838. By John Pickering, Cor. Secretary of the Academy. Boston, 1838.—*From the Author.*

Nouveau Procédé pour la Conservation des Grains; par M. le général Demarçay.—*From M. Hersant, French Consul.*

A Bibliographical Account and Collation of la Description de l'Egypte, presented to the Library of the London Institution, by Sir Thomas Baring, Baronet, President. London, 1838.—*From Mr. William Vaughan.*

FOR THE CABINET.

A collection of shells from the Island of Malta; also four images cut from Malta stone, taken from "St. Paul's Cave," at Citta Vecchia.—*From William Winthrop Andrews, Esq., U. S. Consul at Malta.*

The Committee on the solar eclipse of the 18th of September, made a further Report in part, comprising the following observations:—

Nos. 26 and 27. Observations of Professors Alexander and Henry, at the house of the latter, (lat. $40^{\circ} 20' 50''$, lon. $4h 58m 37.2s$ W. of Greenwich, being $0.1s$ in time W. of Nassau Hall), Princeton College, New Jersey; with a five feet Fraunhofer, yellow screen glass, power 60 for beginning and end, and 40 for the ring, and with a three and a half feet Dollond, dark red screen glass, power 80.

	<i>h</i>	<i>m</i>	<i>s</i>	
Beginning, . . .	3	14	42.71	Henry.
Do.	3	14	43.31	Alexander.
Formation of ring, . . .	4	33	11.27	Both observers.
Rupture of ring, . . .	(not observed.)			
End,	5	46	38.54	Henry.
Do.	5	46	39.24	Alexander.
Mean duration of eclipse,	2	31	54.88	
Do. of ring, (not observed)	less than tabular duration.			

About two minutes before the formation of the ring, Prof. Henry saw, in the Dollond telescope with a red screen glass, an arch of

faint light between the cusps, and shortly afterwards a brush of greater intensity, projecting from near the lower cusp. This phenomenon was not seen by Prof. Alexander in the Fraunhofer with green screen glass, till 61 seconds before the formation of the ring, and then only as a luminous spot. This difference could not have been the result of any oversight on the part of Prof. Alexander; as Prof. Henry, immediately on seeing it, called out to Prof. Alexander, and described its appearance. The optical capacity of the Fraunhofer is superior to that of the Dollond. Prof. Alexander is well known for his nice observations of the annular eclipse of the 13th February, 1831, and of the total eclipse of the 30th November, 1834. Its explanation must be sought for in the nature of the rays of which this arch and brush of light are composed; rays absorbed by the green screen glass, and transmitted by the red. The moon's limb became brightly illuminated at *4h 32m 53.28s*. "An appearance, similar to a row of beads, was regarded as the formation of the ring." "The drops endured for a second or two." Expecting a longer duration of the ring, the attention of the observers was not directed to the sun's limb at the instant of the rupture. The light succeeding the rupture of the ring was visible in the Dollond telescope till *4h 41m 16.27s*, (the minute uncertain, perhaps a minute earlier), having disappeared several minutes earlier in the Fraunhofer refractor.

No. 28. The beginning of the eclipse was observed by William Cranch Bond, at his private Observatory, with a two feet Gregorian, power 44; latitude $45^{\circ} 19' 15''$, longitude *4h 44m 17.29s* west of Greenwich, (or *0.69s* in time west of Boston State House by Mr. Paine's trigonometrical survey) as follows:—

Beginning, *3h 28m 10.90s* mean time of place of observation.
End, lost by clouds.

No. 29. The beginning was observed at *3h 28m 11.6s* at the State House, Boston, by Mr. Borden, with a $3\frac{1}{2}$ feet refractor. Clouds prevented its observation at Cambridge.

The Committee also reported the following observations of R. T. Paine, Esq., on the occasion of his journey to Washington to observe the eclipse. These were made with his sextant, constructed by Troughton for the chronometrical survey of Massachusetts, and carefully corrected by that artist for all sensible error of eccentricity; and with three excellent chronometers used by Mr. Paine in the survey.

Latitude of the Capitol.

Sep. 17th, by 21	observed altitudes of both limbs				
			of the sun,	38° 53'	23.39''
„ „	16	do.	β ceti,		22.75
„ „	22	do.	Polaris,		21.77
„ 22d	12	do.	both limbs of the sun,		22.31
„ „	12	do.	Polaris,		22.70
„ „	7	do.	β ceti,		24.89
					<hr/>
By mean of 56 altitudes of sun and southern stars,					23.16
Do. of 34 do.		Polaris,			22.24
					<hr/>

Latitude of the Capitol, 38° 53' 22.7''

The corrections of the chronometers were determined by Mr. Paine for Boston State House, from transit observations of Mr. Bond, at Dorchester; those for Philadelphia State House, by eastern and western altitudes of stars, observed at the High School Observatory, by Messrs. Paine, Riggs, Walker, and Kendall, with the Troughton's sextant, circle, a Pistor's sextant, and a sextant (maker's name unknown) reading to 10''. Those for Washington were made by Mr. Paine. The daily rates of the chronometers for Washington were on mean time,

	<i>s</i>
151 Barraud	— 14.27
682 do.	+ 1.67
1678 Arnold	+ 8.46.

With these rates, the condition of the chronometers at the beginning of the eclipse was as follows:—

151 Barraud.	682 Barraud.	1678 Arnold.	
$\overbrace{\hspace{2cm}}$	$\overbrace{\hspace{2cm}}$	$\overbrace{\hspace{2cm}}$	
<i>m s</i>	<i>m s</i>	<i>m s</i>	
+ 19 31.59	+ 25 11.27	+ 31 46.21	by 8 W. alt's of sun, Sep. 17.
31.18	11.52	46.43	9 E. „ α Tauri, „
30.96	11.61	46.34	4 E. „ α Orionis, „
31.70	11.20	46.12	12 E. „ sun, „
32.65	12.13	47.14	8 E. „ α Androm, 18.
31.70	11.38	46.34	12 E. „ sun, „
<hr/>	<hr/>	<hr/>	
+ 19 31.68	+ 25 11.48	+ 31 46.41	Mean of 53 altitudes.
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The longitude of the State House, Boston, is stated by Mr. Paine

to be $4h\ 44m\ 16.6s$, as the result of all the observations yet made. It is the same as that which Dr. Bowditch had deduced from those of 1811 and previous. The longitude of the State House, Philadelphia, obtained by Mr. Walker from the principal observations made at Philadelphia to this time, is $5h\ 0m\ 39.2s$. With these longitudes as standards, Mr. Paine's chronometric observations give,

Boston—Philadelphia by 151 Barraud	m	s		
	16	24.27	going from Boston to Phila.	
682 do.		22.30	do.	
1678 Arnold		24.03	do.	
151 Barraud		23.33	returning from Phila. to Boston.	
682 do.		23.60	do.	
1678 Arnold		23.76	do.	
Philadelphia—Capitol by 151				
682	}	Mean 7 26.43	going from Phila. to Capitol.	
1678	}			
151	}	Mean 7 26.50	returning from Capitol to Phila.	
682	}			
1678	}			

$$\begin{aligned} \text{Hence, longitude of Capitol} &= 4\ h\ 44\ m\ 16.6\ s + 23\ m\ 50.01\ s = 5\ h\ 8\ m\ 6.61\ s \\ &= 5\ h\ 0\ m\ 39.2\ s + 7\ m\ 26.46\ s = 5\ h\ 8\ m\ 5.66\ s \end{aligned}$$

$$\text{Mean} = 5\ h\ 8\ m\ 6.14\ s$$

Mr. Walker, in a paper read before the Society, March 2, 1838, from a discussion of all the observations then made at Washington, finds the longitude of the Capitol $5h\ 8m\ 7s$, a value which is probably not far from the truth.

Thus we have an additional proof, if any were needed, of the error of 25 seconds in time of Lambert's longitude of the Capitol, reported to Congress and adopted by that body.

The coincidence between the interval from Boston to Philadelphia, viz.

By celestial phenomena,	m	s
	16	22.60
By chronometers,	16	23.55

shows that the error of either is reduced within narrow limits.

The Mansion House, Northampton, Mass., lat. $42^\circ\ 19'\ 4.6''$ by 327 altitudes of northern and southern stars, has the following longitude:—

Boston—Northampton,	m	s	
	6	17.72	by 74 chronometers.
Do.	6	17.89	by immersion τ Sagittarii.
Northampton—Philad.	10	4.06	by do.

This immersion of τ Sagittarii was observed, Aug. 22d, 1836, as follows:—

	<i>h</i>	<i>m</i>	<i>s</i>	
By R. T. Paine,	at 10	14	57.46	at Mansion House, Northampton.
By W. C. Bond,	at 10	23	20.90	at his Observatory.
By S. C. Walker,	at 10	1	7.30	at N. 4.4", W. 1.06s of S. House, Ph.

Again, for the longitude of Brown University, Providence, Mr. Paine finds,

	<i>m</i>	<i>s</i>	
Boston—Providence,	1	22.64	by 40 chronometers.
Do.	1	22.29	by eclipse of May 15th, 1836.

Mr. Paine's observations of the eclipse of Sep. 18th have already been reported. Those for latitude and regulation of chronometers have been stated more at length, in order to furnish examples of the method pursued by that gentleman in the chronometric survey of Massachusetts, the only work of the kind of much extent hitherto performed in this country. Some idea of the labours of Mr. Paine may be formed from the fact, that, during its progress, he has been under the necessity of making and reducing more than 100,000 observations of altitudes of the sun and stars, without any assistance.

It is proper to add that Mr. Gilliss' observations, already reported, appear to require a subtractive correction of 1.95s. Thus Mr. Paine's observations give,

	<i>h</i>	<i>m</i>		<i>m</i>	<i>s</i>
Sep. 18th, 21	25,	Barraud	151 fast by its own rate	+ 19	20.80
		by comparison with	682 Barraud,		20.91
			1678 Arnold,		20.89
		by mean of three chronometers,		19	20.87
		by Mr. Gilliss' transit observations,		19	22.82
		Discrepancy,			1.95

Professor Henry read a paper entitled "Contributions to Electricity and Magnetism, No. 3. On the Phenomena of Electro-dynamic Induction." Referred to Prof. A. D. Bache, Dr. Patterson, and Dr. Hare.

The primary object of the investigation undertaken by the author, was the discovery of induced currents from ordinary electricity, similar to those produced by galvanism. Preparatory to this, a new investigation was instituted of the phenomena of galvanic induction, and the result of this forms, perhaps, the most important part of the communication.

The first section of the paper refers to the conditions which influence the induction of a current on itself, as in the case of a long wire and a spiral conductor. These are shown to depend on the intensity and quantity of the battery current, and on the length, thickness, and form of the conductor.

The next section examines the conditions necessary to the production of powerful secondary currents, and also the changes which take place in the same, when the form of the battery, and the size and form of the conductor are varied. The important fact is shown, that not only a current of intensity can be induced by one of quantity, but also the converse, that a current of quantity can be produced by one of intensity.

The third section relates to the effect of interposing different substances between the conductor which transmits the current from the battery, and that which is arranged to receive the induced current. All good conducting substances are found to screen the inducing action, and this screening effect is shown, by the detail of a variety of experiments, to be the result of the neutralizing action of a current, induced in the interposed body. This neutralizing current is separately examined, and its direction found to be the same as that of the battery current. The question is then raised, how two currents in the same direction can counteract each other? An answer to this question is given in a subsequent part of the paper.

The fourth section relates to the discovery of induced currents of the third, fourth, and fifth orders;—that is, to the fact that the second current is found capable of inducing a third current, and this latter again another, and so on. The properties of these new currents are next examined, and the screening influence is found to take place between them; quantity is induced from intensity, and conversely; magnetism is developed in soft iron; decomposition is effected, and intense shocks are obtained, even from the current of the fourth order. A remarkable and important fact is stated in reference to the direction of these currents. If the direction of the battery current and that of the second be called *plus*, then the direction of the third current will be *minus*, of the fourth current *plus*, of the fifth *minus*, and so on. The application of the fact of these alternations is made to the explanation of the phenomenon of screening before mentioned, and also to the improvement of the magneto-electrical machine.

The last part of the paper relates to the discovery of secondary currents, and of currents of the several orders, in the discharge of

ordinary electricity. Shocks are obtained from these; the screening influence of good conductors is shown to take place; magnetism is developed; and the alternations in the direction are found to exist as in the currents from galvanic induction. Some remarkable results are given in reference to the great distance at which the induction takes place. Experiments are detailed in which needles were made magnetic, when the conductors were removed to the distance of twelve feet from each other.

Prof. Henry made a verbal communication, during the course of which he illustrated, experimentally, the phenomena developed in his paper.

Stated Meeting, November 16.

Present, twenty-four members.

Mr. DU PONCEAU, President, in the Chair.

The following donations were received:—

FOR THE LIBRARY.

The Good Fellow, by Paul de Kock. Translated from the French by a Philadelphian. Two Volumes. Philadelphia, 1837.—*From Daniel J. Desmond, Esq.*

Allgemeiner Hand-Atlas der Ganzen Erde. Weimar, 1811.—*From the same.*

Kongl. Vetenskaps-Academiens Handlingar, för Aor 1836. Stockholm, 1838.—*From the Academy.*

Aorsberättelse om Framstegen i Fysik och Kemi afgifven den 31 Mars 1836; af Jac. Berzelius. Stockholm, 1836.—*From the Royal Swedish Academy.*

Aorsberättelse om Technologiens Framsteg afgifven den 31 Mars 1836; af G. E. Pasch. Stockholm, 1836.—*From the same.*

Aorsberättelse i Astronomien af S. A. Cronstrand. Den 31 Mart. 1836. Stockholm, 1836.—*From the same.*

Aorsberättelser om Nyare Zoologiska Arbeten och Upptäckter, afgifne den 31 Mars 1835 och 1836, af B. Fr. Fries. Stockholm, 1837.—*From the same.*